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TRANSLATOR'S AFFIDAVIT

I, Andrew Wilford, a citizen of the United States of America, residing in Dobbs Ferry, New York, depose and state that:

I am familiar with the English and German languages;

I have read a copy of the German-language document PCT application PCT/EP2004/008328 published 28 April 2005 as WO 2005/037428; and

The hereto-attached English-language text is an accurate translation of this German-language document.

Andrew Wilford

Sworn to and subscribed before me
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STACKED PACKING FOR HEAT EXCHANGE AND MASS TRANSFER

The invention relates to a stacked packing for a heat-exchange or mass-transfer column with at least one packing comprised of several layers.

In EP 1 074 296 (Translator's note: US equivalent 6,427,985) a stacked packing is described where the individual packings are each formed of two separate packing layers of different geometry. Here the lower packing layer is of tighter geometry than the upper packing layer. The packing is operated such that the lower packing layer is made to bubble with high mass transfer. The overlying coarser packing layer separates out the bubbles and has film flow so that it works like a conventional packing.

When such a packing is used, it is very sensitive when not set perfectly horizontally, especially when the column diameter is greater than 1 m. When tipped there is uneven liquid distribution across the column. Thus there are liquid-filled zones with lower gas throughput. This nonuniformity has a bad effect on the otherwise high separation capacity.

It is an object of the invention to provide a packing of the named type that produces uniform liquid distribution over the flow cross-section of the column.

This object is achieved according to the invention in that the lower packing layers are of greater density and therefore have a greater surface area than other layers.

It has been discovered that the sensitivity to nonuniform distribution can be greatly reduced when the geometry of the tight flooded packing layers is modified. In contrast to the convention column packings the packing according to the invention does not have uniform geometry of the individual layers, but this changes horizontally, vertically, or preferably both horizontally and vertically. The packings are used such that the lower packing layer always has a bubble action with high mass transfer and the overlying coarser packing layers act as drop separators and have the liquid film of conventional packings.

The packing layers with greater density and, hence, greater surface area resist the passage of gas up through them so the gas moves upward more slowly and the liquid in these layers is pushed downward more strongly. In this manner inside the packing layer there is liquid and gas recirculation leading to an optimal distribution of the liquid. This also ensures that the liquid moves downward in sufficient volume.

Advantageous features of the invention are set out in the dependent claims.

Two embodiments of the invention are shown in the drawing and described more closely in the following, therein:

FIG. 1 is a first embodiment of a packing or packing assembly in section,

FIG. 2 is a second embodiment of a packing or packing assembly in section,

FIG. 3 is a third embodiment of a packing or packing assembly in section,

FIG. 4 is a fourth embodiment of a packing or packing assembly in section.

A column holds several packing assembles extending horizontally one above the other. The assemblies each have one or more packings 1 that are each formed of an upper packing layer 2 and a lower packing layer 3.

The first embodiment of FIG. 1 has a conventional cross-channel upper layer 2 where the individual packing layers 4 have the same geometry and same specific surface area horizontally and vertically. The upper packing layer 2 is of lesser density and has a smaller specific upper surface area. The lower packing layer 3 is of greater density and has a greater specific surface area.

FIGS. 1 and 2 are sections of the packings according to the invention where the lower packing 3 has packing layers 4a and 4b oriented horizontally and having at least two different gross specific surface areas. As a rule the two thinner denser packing layers 4b with the greater specific surface area are directly against each other. Between these layers 4b with the larger

specific surface area there are 1 to about 10, preferably 3 to 6, adjacent layers 4a of smaller specific surface area.

The specific surface area of the layers 4a with the smaller specific surface area corresponds in the art with standard geometry to a specific surface area of about 100 to 1200 m^2/m^3.

The layers 4b with the greater specific area have a specific surface area that is bigger by a factor of 2. The basis for this very large specific surface area lies in the insert deflecting function used in standard distillation systems.

While the coarse packings effect a counterflow of gas and liquid with bubble formation, the interstices of the packing layers 4b with the greater specific surface are preferably only or primarily traversed by liquid. In these liquid-filled interstices there is good distribution of a portion of the liquid flow and uniform distribution. Such packings 3 are therefore effective as flow spreaders. They render partially or wholly unnecessary the provision of liquid collectors and distributors.

Astonishingly, experiments have shown that in the layers the liquid goes very freely into the narrow flow passages and is distributed uniformly along the passages.

The tight and dens packing layers 4b can be made of different materials that have perforations, for example sheet metal, expanded metal, or wire mesh.

For bubbling action in the lower packing layer 3 it is necessary that the two packing layers 4a and 4b have perforations over 10 to 50% of their height so as to permit passage of liquid out of the narrow interstices into wider passages. The wider

openings thus take up from 5 to 20% of the overall surface area of the packing layer.

It has been shown to be particularly advantages when the tight packing layers 4b project from the lower end of the tight packings about 2 to 50 mm, preferably 5 to 20 mm, while the layers are flush at the upper side (FIG. 3) or of different heights at the upper side (FIG. 4).